HW 18 Bernoulli's Principle

1) Using your newly acquired knowledge of Bernoulli's Principle explain how to lift a coin into a small container without touching it. Please include a carefully labeled diagram to aid in your explananation. (You should use multiple mature coherent sentences).

Blowing over the top of the coin increases the velocity of the air above the coin. From Bernoulli's Principle, we know that the air above the coin lowers in pressure. The relatively higher air pressure under the coin pushes it up and into the jar.

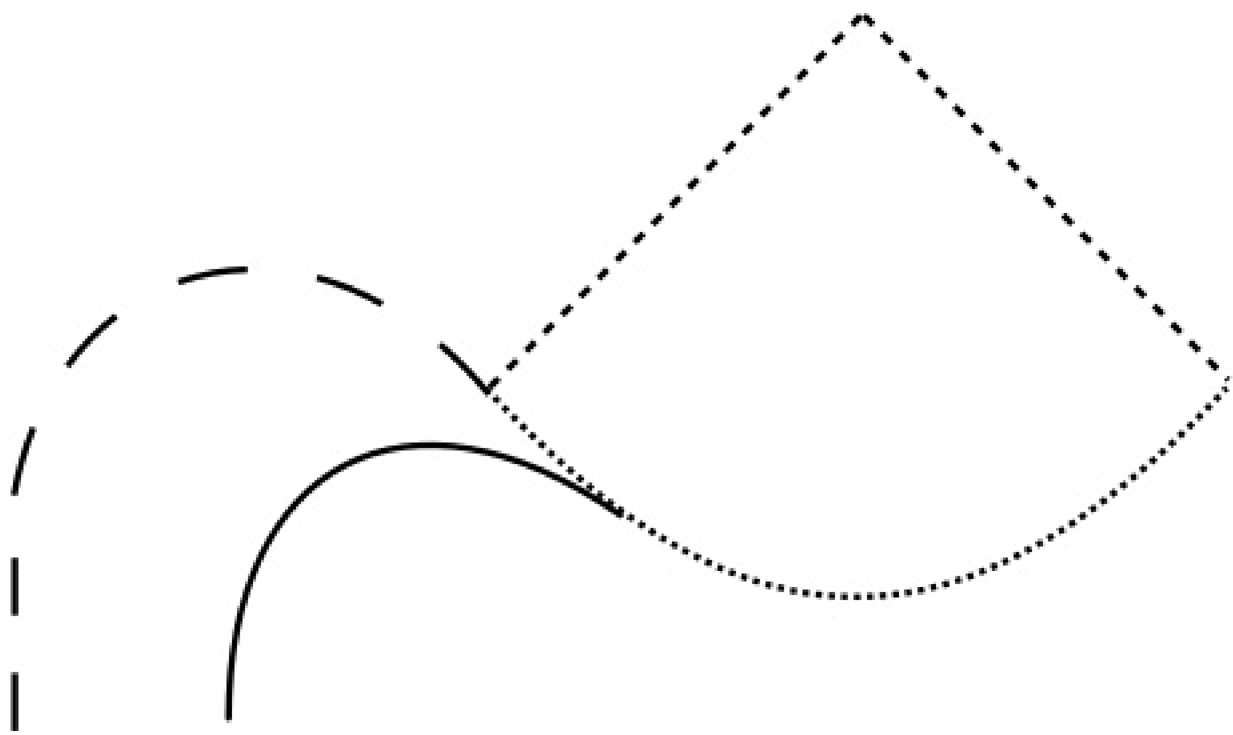
2) Starting from rest at point A, a 50kg person swings along a circular arc from a rope attached to a tree brach over a lake, as shown in the figure. Point D is at the same height as point A. The distance from the point of attachment to the center of mass of the person is 6.4m. Ignore air resistance and the mass and elasticity of the rope.

a) The person swings two times, each time letting go of the rope at a different point.

i) On the first swing, the person lets go of the rope when first arriving at point C. Draw a solid line to represent the trajectory of the center of mass after the person releases the rope.

ii) A second, the person lets go of the rope at point B. Draw a dashed line to represent the trajectory of the center of mass after the person releases the rope.

The lines are initially tangent to the curve.



b) The center of mass of the person standing on the platform is at point A, 4.1m above the water. Calculate the gravitational potential energy when the person is at point A relative to when the person is at the surface of the water.

$$U_g = mg\triangle y$$

$$U_g = 50kg \times 9.8\frac{m}{s^2} \times 4.1m$$

$$U_g = \boxed{201J}$$

c) The center of mass of the person at point B, the lowest point along the arc, is 2.4m above the surface of the water. Calculate the person's speed at point B.

$KE = U_g$

$\frac{1}{2}mv^2 = mg\triangle y$

$v^2 = 2g\triangle y$

$v = \sqrt{2g\triangle y}$

$v = \sqrt{2 \times 9.8m/s^2 \times 1.7m}$

$v = \boxed{5.77m/s}$

d) Suppose that the person swings from the rope a third time, letting go of the rope at point B. Calculate R, the horizontal distance moved from where the person releases the rope at point B to where the person hits the water.

$v_{yo}t + \frac{1}{2}gt^2 = \triangle y$

$(0m/s)t + \frac{1}{2}9.8m/s^2t^2 = 2.4m$

$t = \frac{2 \times 2.4m}{9.8m/s^2}$

$t = 0.700s$

$5.77m/s(0.7sec) = \boxed{4.04m}$

e) If the person does not let go of the rope, how does the magnitude of the person's momentum p_c at the point C compare with the magnitude of the person's momentum p_b at point B.

$\boxed{p_c < p_b}$

Momentum is equal to mass · velocity. The mass is the same at both points, but the velocity is smaller at point C, so the momentum is smaller at point C.